

The claims defining the present invention are as follows:

1. A mechanical door closer to extend between a door and an associated door jamb to urge the door to a closed position with respect to the door jamb, said closer including:
 - 5 an elongated track to be fixed to the door or door jamb;
 - a carriage mounted on the track for movement there along;
 - a connecting member attached to the carriage and extending therefrom to attach the carriage to the door jamb if the track is attached to the door, or to attach the carriage to the door if the track is attached to the door jamb, so that movement of the door in a closing direction causes movement of the carriage in a predetermined direction;
 - 10 a biasing member urging said carriage to move in said predetermined direction along the track and wherein said track and connecting member are intended to be attached to the door and door jamb so that upon opening movement of the door said carriage is caused to move along said track in a direction opposite said predetermined direction; and
 - 15 wherein
 - said carriage includes a brake mechanism to restrain movement of said carriage in said predetermined direction, said brake mechanism having:
 - a first brake part, said first part being mounted for rotational movement about an axis transverse of said track and having at least one ramp surface extending angularly and axially with respect to said axis, said first part being engaged with said track to cause rotation of said first part in a predetermined angular direction when said carriage is moved in said predetermined direction along said track;
 - a rotatable element engaged with said ramp surface;
 - a second brake part, said second part being mounted adjacent said first part and having a surface to engage said element;
 - 25 a brake surface; and wherein
 - relative angular movement between the first and second parts by rotation of said first part in said predetermined angular directions causes said element to move along said ramp surface to separate the first and second parts axially and move said brake surface against an adjacent surface so that a friction force is applied to said brake surface to restrain movement of said carriage in said predetermined direction.
2. The closer of claim 1 wherein said second brake part retains said element in position with respect to said ramp surface.

3. The closer of claim 1 or 2 wherein said first part has a plurality ramp surfaces, and a rotatable element cooperating with each ramp surface and engaged with said second part surface to cause the separation of the first and second parts.

4. The closer of claim 1, 2 or 3 wherein each ramp surface also extends
5 radially relative to said axis.

5. The closer of claim 4 wherein each ramp surface is inclined to said axis by an angle, said angle being between 12° and 20°.

6. The closer of claim 5 wherein said angle is about 16°.

7. The closer of claim 1 or 6 wherein said track is adapted to be attached to
10 said door and said connecting member is an arm, said arm being pivotally attached to said carriage, and adaptably to be pivotally attached to said jamb for pivoting movement about an arm axis.

8. The closer of claim 7 wherein said biasing member is a spring that is tensioned upon movement of said carriage in said opposite direction.

15 9. The closer of claim 8 wherein said spring is elongated and has a first extremity attached to said track and a second extremity attached to said carriage.

10. The closer of claim 1 wherein said track has a longitudinally extending slot defined between first part engaging longitudinal surfaces, and said first part has a generally cylindrical portion positioned to engage said longitudinal surfaces so that upon
20 engagement of said cylindrical portion with a first one of said longitudinally extending surfaces said first part is caused to rotate in said predetermined angular direction.

11. The closer of claim 10 wherein said first part has said brake surface and said carriage includes a brake member providing a further brake surface, with said brake member being operatively associated with said second part so that upon separating
25 movement of said first and second parts the brake surfaces are urged into friction engagement with said track.

12. The closer of claim 11 wherein said second brake surface is located internally of said track and said first brake surface is located externally of said track.

13. The closer of claim 11 wherein said carriage includes an axle member
30 securing the carriage to said arm and upon which said second and first parts are mounted for angular movement thereabout, with said axle member providing said axis.

14. The closer of claim 1 wherein said door closer is adapted to be attached to a sliding door, said track is to be fixed to the door jamb and said carriage includes a roller fixed to the first brake parts to cause the rotation thereof, and engaged within said

track, and said connecting member is adapted to be attached to said door so that the door is supported on said roller.

15. The closer of claim 14 said roller is part of said first part.

16. The closer of claim 1 said biasing member is a spring operatively
5 associated with said arm to urge said arm to move said carriage in said first direction.

17. The closer of claim 16 said spring is a coil spring.

18. The closer of claim 16 wherein said spring is a spiral spring.

19. The door closer of claim 7 further including:

a lever fixed to said arm so as to pivot therewith about said arm axis, and
10 wherein said spring is an elongated coil spring and said lever has an arcuate spring engaging surface from which said spring extends, which surface varies in radial distance from said arm axis so that said spring acts on said lever at a radial distance with respect to said arm axis that reduces as said door moves in an opening direction.

20. The door closer of claim 19 wherein said arcuate surface is configured
15 so that torque applied to said lever is substantially constant.